

Compliments of the Author



A CLINICAL STUDY OF ELEVEN CASES OF ASIATIC
CHOLERA TREATED BY HYPODERMOCLYSIS
AND ENTEROCLYSIS.¹

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THIS evening I shall give a short description of the clinical history and treatment of eleven cases of Asiatic cholera that I had the opportunity of observing at the Swinburne Island Hospital in New York Bay in September, 1892.

The first case was typical of a group that may be called mild cases, and occurred in a Russian, aged 16 years, admitted to the ward September 9 from the steamship Bohemia. His temperature was 99.2° F., pulse 94, and respirations 24. Three more observations, which were continued until midnight, gave the same results. The first matter vomited after admission was composed of a greenish liquid mixed with mucus. The diarrheal discharges were whitish in color and rice-water like in character. The pulse was of fair volume; he complained of abdominal pain of moderate severity. He slept well and passed a normal quantity of urine. It is worthy of note that at no time was the temperature below normal. After remaining in the cholera ward three days he was discharged fully convalescent. The spirillum of cholera was detected in the discharges.

His treatment was as follows: Upon admission he was given ten grains of calomel, and afterward he received one grain every hour for six hours. He was also given two quarts of a one per cent. solution of tannic acid at a temperature of 104° F., by enema, every three hours. At no time was it necessary to resort to subcutaneous injections of the six-tenths per cent. solution of sodium chloride. He was also given

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twenty minims of whiskey hypodermatically, and occasionally one-eighth grain of morphine.

The second case well illustrates an ordinary attack of Asiatic cholera. A Russian, aged 7 years, was admitted from the steamship Bohemia, September 26, at 8 P.M., with a temperature of 96.2° F., pulse 106, respirations 22, and the surface of the body extremely cold and cyanotic. The face was pinched, especially in the nasal region, it was markedly cyanotic, and the eyes were deeply sunken and surrounded by dark circles. The pulse was feeble and small and was counted with difficulty. She at once received a warm plunge bath, and her stomach was then washed out with one pint of a one per cent. solution of tannic acid at the temperature of the body. Shortly afterward she vomited twenty-three ounces of fluid. She remained in about the same condition during the night, but the passage of a moderate amount of urine encouraged us to hope for a favorable issue. On September 27 her pulse was 104, her temperature 97.4° F., and her respirations 18 to the minute. The cyanosis persisted, there was no vomiting, but she had frequent copious discharges from the bowels, composed chiefly of the tannic acid solution which had been injected per anum. Later in the day improvement began, the temperature varied between 100.2° and 100.4° F.; a large semi-solid stool was passed. She slept moderately well during the night, but complained greatly of thirst. A sufficient quantity of urine was excreted, and the liquid from the bowels was composed chiefly of the tannic acid solution that had been given by injection. She became very restless, but the following day was much brighter and began to notice her surroundings. The dejecta changed in character becoming greenish in color and somewhat frothy. On September 29 she slept well; her bowels were moved only after giving the intestinal injection of tannic acid solution. In the afternoon her improvement was so marked that it was decided to suspend these injections. Her temperature varied from 97.8° to 99.4°, the pulse between 96 and 120, and the respirations from 22 to 24. On September 30 she was able to take nourishment and stimulants by the mouth, but the stools continued brownish and thin, and when an attempt was made to administer beef-tea or any food by the mouth, vomiting occurred. The cyanosis disappeared, and it was then observed that she was shrunken and emaciated. She continued to improve, and on the fourth day after admission was carried into the open air, where she received a sun-bath for two hours.

The following summary of the treatment may not be without interest. Upon admission she received a hot plunge bath. The first enteroclysis or intestinal injection was retained for three minutes, and afterward these injections were repeated every two hours. A subcu-

taneous injection of one pint of a six-tenths per cent. solution of sodium chloride was given the day after admission. At first whiskey was administered by the mouth, but afterward ten minims were given hypodermatically every four hours. The total duration of the patient's illness was five days, and her convalescence was extremely rapid and uninterrupted.

The third case presented the typical symptoms of Asiatic cholera, and death occurred forty-one hours after admission to the hospital. The patient was a Russian boy, aged two years, who was admitted to the ward from the steamship Bohemia at 2 P.M. He complained of pain, and vomited and purged freely. His face had the bluish and shrunken appearance that is so characteristic of this disease. The upper and lower extremities, as well as the face, were cold and cyanotic. The pulse was very weak, about 100 per minute, and the respirations were shallow, averaging forty-two per minute. The temperature was 98° F. and soon descended to 97.4° F. He made no complaint of pain nor of muscular cramps. At first everything taken by the mouth was vomited, but soon this symptom subsided. The bowels moved frequently, the discharges were copious in quantity, whitish, and contained a large quantity of epithelium, giving them a rice-water like appearance. The patient soon became apathetic, and during the night continued to purge and vomit, and during the day the cyanosis became extreme, especially in the face and extremities. The remainder of the skin surface was whitish in color, and when a fold was pinched between the thumb and forefinger it remained elevated for some time, and then gradually resumed its former condition. The pulse became weaker, small, and increased in frequency from 90 to 100; the respirations rapid and shallow; and the temperature varied from 98.8° to 99.6° F. There was no vomiting except that which was excited by attempts to administer food or remedies. During the night he had two copious choleraic discharges from the intestine. He continued in about the same condition until his death.

The spirillum of cholera was obtained from the early intestinal discharges. The autopsy was performed six hours after death. The cadaver presented the same general appearance as has been already described. *All* the tissues and *all* the organs of the body were remarkable for their extreme dryness. Both pleuræ showed extensive old adhesions, particularly on the left side. The lungs, liver, spleen and peritoneum were normal, but *dry*. The kidneys showed acute parenchymatous nephritis. The entire subcutaneous tissue was dry and dark, and the skin when pinched remained elevated, the same as during life. A rectal tube was introduced for a distance of ten inches, to which was attached an ordinary fountain syringe, the reservoir of

which was placed at an elevation of five feet, and contained two pints of water, which was passed through the ileo-cecal orifice, filling the small intestine and stomach.

Upon admission he was placed in a plunge bath having a temperature of 104° F., and calomel in one grain doses was given every hour for three doses. Two pints of a hot one per cent. solution of tannic acid was injected into the intestine every two hours, and also a subcutaneous injection of half a pint of a hot six-tenths per cent. solution of sodium chloride, containing one per cent. of brandy. Every hour \mathbb{M}^v of whiskey were given hypodermatically, and at night oxygen was given by inhalation. All attempts to administer food or remedies excited vomiting.

The fourth case illustrates how rapidly death may occur in cholera. The patient was a Russian emigrant, aged eight years, admitted from the steamship Bohemia at 6 P.M. on September 26. She told us that in the morning, at 2 o'clock, vomiting and purging began, and between the hours of 2 A.M. and 6 P.M. she had three large rice-water discharges from the bowels and two similar discharges from the stomach. Upon admission she presented the characteristic facies of cholera. The orbits were deeply discolored, and there was a suffused reddish-purple blush over the arms, nose, legs and feet. This cyanosis was especially marked on the left side of the neck, arm and leg. This was due to the position assumed while on board the tug boat, which was used in conveying her from the steamship to the hospital. At first she was able to say a few words, but soon became unconscious. Her respirations were very shallow, numbering thirty-five to the minute. Her axillary temperature was 96.6° F. Soon after admission she vomited a moderate quantity of light-brownish fluid, and at 8.15 P.M. she again vomited twenty-eight ounces of a liquid having the same character. At 9.15 P.M. she discharged a large quantity of rice-water liquid per rectum, and she died at 10.15 P.M., four hours and fifteen minutes after admission, or twenty hours from the appearance of the first symptom of the disease.

Upon admission she received a hot plunge bath, and fifteen minutes thereafter her stomach was washed out with one pint of solution of boric acid at the temperature of the body. At 8.45 P.M. she received an enteroclysis of two pints of one per cent. solution of tannic acid at a temperature of 104° F., which was rejected. At 9 P.M. oxygen was used freely, and at 10 P.M. a subcutaneous injection of two pints of distilled water, containing six-tenths per cent. of sodium chloride and one per cent. of whiskey was administered. From time to time whiskey was given by the mouth. Oxygen was continued until her death.

The autopsy was performed eighteen hours after death. Rigor

mortis was extreme, the entire skin surface was dark-bluish in color, as were also the matrices of the nails. The body was considerably shrunk and emaciated. There was but little subcutaneous fat. Both pleuræ were free from adhesions. The lungs were collapsed, dark in color, but otherwise normal. The thymus gland was unusually large, measuring three by two inches. The right ventricles were contracted, and each contained a moderate sized clot. The ventricles and auricles and cavæ were over-distended with blood, coal-black in color, and tar-like in consistency. The small intestine showed exfoliated epithelium and injection of the blood-vessels. The heart muscle and pericardial sac were normal. The liver was moderately enlarged and the right lobe was unusually flattened at its base, and its entire surface was mottled with irregular areas of a whitish, wax-like material passing into the substance of the liver. The left lobe of the liver was infiltrated more uniformly with the same material, but its consistency was normal. The gall-bladder was over-distended with a thick, dark-green bile, containing mucus. The kidneys were cyanotic, but otherwise normal. The spleen was normal in size, and its pulp was black in color and glutinous. The bladder contained about two drachms of pale urine. The gastric and intestinal contents were typical in appearance, and contained the spirillum of cholera. There was complete suppression of urine. The skin and subcutaneous tissues were so dry that when pinched the fold remained for several minutes.

I beg your indulgence while I narrate the history of cases V the most interesting of all observed, and where we were fortunately able to note minutely every change that took place from the beginning to the end. This patient exhibited nearly all the symptoms of a typical malignant case of Asiatic cholera, illustrating also, in an equally striking manner, the results obtained by treatment.

This patient, a male, aged 24 years, a native of Germany; was admitted to the Swinburne Island Hospital on September 27, 1892, at 11 A.M. His muscular and osseous systems were unusually well-developed, and it was reported that he was perfectly well on the morning of September 27th until 4 A.M., when he first complained of pain in the abdomen, which was followed by two loose stools. He continued feeling well until we saw him at 10 A.M., when, in view of the diarrhea, it was deemed wisest to remove him to the hospital, although his general condition did not indicate that he was suffering from cholera. He objected strongly to his removal, and said that he felt perfectly well. He walked from his berth to the side of the ship and down a rope ladder to the quarantine tugboat. He arrived at Swinburne Island and reiterated his statement that he felt perfectly well, and walked from the quarantine boat to the door of the hospital,

when *suddenly* he complained of weakness in the knees and fell to the ground in a state of collapse. He was carried to the ward in a condition of partial stupor, from which he was easily aroused. He responded to all questions in a manner showing that his consciousness was perfectly preserved. Soon he complained of agonizing cramp-like pains in the arms, feet and knees, which recurred more or less regularly at intervals of thirty minutes. Immediately after his admission his countenance presented the typical appearance of cholera. The eyes were deeply sunken and surrounded by dark circles, the pupils were contracted to the size of a pin-point. The lips, cheeks, arms, hands, legs and feet were cyanotic, and the entire skin-surface was dry, and when the skin was pinched it remained elevated and compressed for several minutes. There was no pulse at the wrist. The temperature was 98.5° F., the respirations shallow and 18 per minute, and the voice whispering. I was unable to detect any special coldness in the expired breath. He was at once placed in a hot plunge bath having a temperature of 104° F. and was given four pints of a one per cent. solution of tannic acid at a temperature of 104° F.; also two pints of distilled water at a temperature of 100° F., containing 6-10 of one per cent. of sodium chloride and one per cent. of whiskey. He responded but slightly to this treatment; the pulse was scarcely perceptible, was filiform in character and about 100 per minute. At 11.30, or thirty minutes after his admission, he complained of intense agonizing pain in the legs, feet and hands. These cramps forced the feet into extreme extension, and twisted and distorted the fingers. The pain was so great that it became necessary to administer a hypodermatic injection of gr. one-eighth of morphine. The hypodermoclysis and enteroclysis were repeated. Camphor was given him hypodermatically. He inhaled oxygen constantly, hot bottles were applied to the extremities, and hot air was conducted under the bed-clothing from a large steam radiator. He now vomited a large quantity of a clear liquid and passed several copious rice-water discharges from the bowels. His collapse deepened; the pulse became slow, feeble and almost imperceptible; and his respirations shallow. His intellection was clear, and his condition is best described by the word "terror." At 2.30 P.M., or three hours and thirty minutes after admission, he was extremely restless and anxious, and the choleraic intestinal discharges continued. He moved from side to side, tossing the arms about wildly and calling aloud for air. The hypodermoclysis was repeated and hydrochloric acid and brandy were administered by the mouth. At 5 P.M. he was pulseless and complained most bitterly of intense pain, produced by the tonic spasm of the muscles. These cramps were so violent that the muscles were knotted and felt board-like. At 6 P.M. the hypodermoclysis was

repeated; the pulse was scarcely to be felt, and thirty minims of whiskey were given hypodermatically and repeated for five doses, but with no effect. He now passed two copious liquid stools containing whitish shreds composed of intestinal epithelium, giving the discharges their rice-water like appearance. At 6.30 P.M. he passed three more stools, and at this time we were unanimously of the belief that he must speedily die. At 7 P.M. he showed slight reaction; his extremities became a trifle warmer and the pulse more easily counted. At 10 P.M. hypodermoclysis and enteroclysis were repeated and a hypodermatic injection of twenty minims of whiskey was given every thirty minutes until 1 P.M. At 11 P.M. the intellect was clear; the eyes were horribly sunken and surrounded by dark circles; the nose pinched; the face shrunk; the voice whispering and so feeble that he was compelled to rest between words in replying to questions. He now complained of pain in the chest and renal regions. His extremities grew warmer and perspiration was visible on the trunk. This symptom was peculiar and rare, as in none of our other cases was perspiration visible. The mental condition—terror—persisted. At this time he ejected large quantities of rice-water liquid by five acts of emesis. At 1 P.M., September 28th, this slight improvement continued, and the hypodermoclysis and enteroclysis and hypodermatic injections of whiskey were repeated. At this time he had three movements of the bowels which were composed of the tannic acid solution given by injection. At 5 A.M. a hypodermoclysis and a subcutaneous injection of whiskey were administered, and at this time the improvement was quite marked and he slept quietly for a few hours. At 8.30 A.M. the enteroclysis was repeated and the whiskey suspended. At 9 A.M. his physiognomy underwent a truly remarkable change for the better, the face became slightly flushed, the ghastly, deathlike pallor disappeared, the expression about the eyes became more natural and the entire skin surface, especially that of the extremities, was warm, and the pulse was of full volume, soft in quality, regular, beating 100 per minute. At 11 A.M. it seemed incredible that such wonderful changes could have occurred in the twenty-four hours which had just elapsed. At 10.30 A.M. the enteroclysis was repeated, and at 10.50 A.M. the pulse was full, regular, soft, and 88 per minute; the respirations were normal and the expression good. He responded intelligently to questions, and the improvement continued.

In both flanks where the needle had been inserted repeatedly for the subcutaneous injection of the sodium chloride solution, the tissues were hyperemic and sensitive to the slightest touch. No extravasation of blood occurred, and in three days these symptoms disappeared. At no time was a single drop of urine excreted. In ordinary cases the

rate of absorption, after the hypodermoclysis, varies between forty and sixty minutes, whereas in this case three hours were required, thus showing that the power of absorption had been almost abolished. So soon as the liquid was absorbed a second enteroclysis was given. Hypodermatic injections of twenty minims of whiskey were repeated almost hourly until midnight. He passed a good night, vomiting but twice, and had dark-colored stools. His general condition remained unchanged. On September 29th he received champagne and now recognized that he was convalescent. He was given whiskey and Seltzer water, equal parts, every three hours, and at 10.45 A.M. for the first time, precisely forty-eight hours after admission, he passed one pint of urine. The examination of this urine showed a distinct trace of albumin; no sugar; a sp. gr. of 1024; an acid reaction; and in the sediment numerous granular tube-casts. The liquid movements continued every two hours; and again he passed a normal quantity of urine. On September 30th the diarrhea continued to average one stool every two hours, the quantity passed was small and the color had become dark. The patient was excessively irritable and nervous. He improved slowly for two days and then sank into a typhoid state.

There was no enlargement of the spleen or elevation of temperature.

As we feared, but little improvement occurred, and the typhoid state continued until death, which took place on October 5, or eight days after his admission to the hospital.

The post-mortem examination revealed the ordinary changes that are found in cholera; the kidneys showed a severe grade of acute parenchymatous nephritis.

The sixth case was of moderate severity, and the occurrence of an acute gastritis seemed to act as a predisposing cause. He was a native of Russia, aged 12, admitted from the steamship *Rugia* to Swinburne Island on September 8 as a cholera suspect, suffering with diarrhea and vomiting. The fluid ejected was light in color and large in quantity. He soon improved and was placed at work filling wine bottles, and drank freely of the red wine until he became thoroughly intoxicated. He thereby acquired an acute catarrhal gastritis, the symptoms of which increased on the following day, and soon afterwards he vomited and purged large quantities of rice-water like liquid. His temperature, pulse and respiration remained normal. He rapidly grew worse and soon passed into a stage of collapse. On September 13 his diarrhea continued; he passed a normal quantity of urine, but there had been no vomiting for several hours. The stools were light in color, largely admixed with the tannic acid solution which had been injected per anum. The temperature remained normal.

On September 14 the diarrhea continued, and frequent vomiting

occurred. The urine was normal in quantity and appearance. The small quantities of whiskey given by the mouth were promptly rejected.

On September 15 vomiting was frequent, with excessive retching and choking, and there was considerable abdominal pain complained of. The urine became scanty and rather high colored.

On September 16 the temperature was 97° F., respiration slow and labored, pulse very weak and scarcely perceptible, beating 100 per minute. Complaint was made of excessive weakness and restlessness. The face and upper and lower extremities, became cyanotic. After the subcutaneous injection of a quart of hot liquid containing three-tenths per cent. of sodium chloride and one per cent. of whiskey, his pulse became stronger and a marked improvement in his general condition was noted.

On September 17 he complained of considerable pain in the lower abdominal region with great restlessness; the vomiting decreased in frequency and amount, and the patient gradually grew stronger.

On the 18th he was stronger, and on the 22d he was discharged from the ward. Bacteriological examination of the dejecta showed the presence of the spirillum of cholera.

Treatment. In the beginning he was given a hypodermoclysis every two or three hours, averaging a pint, and this was continued in conjunction with enteroclysis, three to six pints, at intervals of four or more hours, according to his condition. Twenty minims of whiskey were given hypodermically, and oxygen was administered p. r. n. His diet was liquid, chiefly composed of milk and beef juice.

The seventh case was unusually mild, and was interesting from the total absence of vomiting. He was a native of Russia, aged 10, admitted from steamship Candia, September 14, with choleraic discharges which continued during the next day, and ceased September 16; at no time was there vomiting. The spirillum of cholera was detected in the dejecta. He was discharged on September 19. Treatment: calomel, grs. vj; enteroclysis every four hours until three were given. No hypodermoclysis.

The eighth case was one of great severity, with marked gastric symptoms; recovery in ten days. The woman was a Russian, aged 28, was admitted from the steamship "Scandia" on September 10 with the diagnosis of cholera, complaining of continuous vomiting, which was at first associated with a burning sensation in the epigastrium. Her extremities and face were cold and cyanotic and her physiognomy was typically choleraic. Her intestinal discharges were copious and frequent and rice-water like in appearance. So many patients were admitted at this time that it was impossible to make careful observations regarding the pulse, temperature and respiration.

For several hours she was pulseless, respiration shallow, 20 per minute, and temperature 97° F. On the following day vomiting and diarrhea were almost continuous. On September 12 she had but one intestinal discharge, but the vomiting continued almost constantly and was rice-water like in character. Medicines and food when administered by the mouth were immediately rejected. September 13, vomiting still continued; towards the close of the day some liquid ejecta were bile-stained, there was no intestinal discharge. On September 14, vomiting continued, but still no movement of the bowels, though enemas were given at 9 A.M. and 6 P.M. with the idea of securing evacuations. On September 15, vomiting continued with much less frequency and a stool was secured by enema. On September 16, there were numerous acts of vomiting and one normal stool. On September 18, she was convalescent, and on the 21st was discharged from the hospital. The spirillum of cholera was found in the matter vomited.

Treatment.—At first she received a plunge bath, the water having a temperature of 104° ; enteroclysis, two quarts, for two days, and one hypodermoclysis of two pints of the saline solution. Attempts were made to administer champagne and whiskey by the mouth, but they were both rejected. On September 13, she received ten grains of calomel, which was repeated on September 15. Ten drops of hydrochloric acid were given from time to time.

The ninth case, like the sixth, would seem to illustrate how an acute gastric irritation or catarrh increases the susceptibility to cholera. It is probable that he was infected during his stay in the hospital, inasmuch as there was no cholera on board the ship for some days, he showed no choleraic symptoms until the evening of the second day after his admission to the cholera ward. He was a Polish Jew, aged 18, a butcher by occupation, and a steerage passenger on the steamship Bohemia, which arrived on September 15. He was admitted to the wards on Swinburne Island on September 21. He had a well-developed osseous and muscular system and seemed fairly strong. The face was of a dark red color, especially in the nasal and maxillary regions; the eyes were deeply sunken with dark lines surrounding them; but the intellect was clear; the tongue was pointed and its dorsum was covered with yellowish-brown fur.

The first symptom was diarrhea, which was repeated three times during the day. While on the ship he was bottling wine and drank to excess, and, in consequence he had several attacks of vomiting which were accompanied by great pain and retching. On the morning of September 21 he was quite well and was discharged from the convalescence ward, and during the night he had three large passages which

were fluid, yellow and painless. On September 22, he had three intestinal movements, liquid, and yellow, in which floated shreds of intestinal epithelium. The next day movements occurred smaller in amount and less frequent, and there was no vomiting; the urine was scanty. The rectal temperature was 100.6; pulse was 98; respirations 19. He gradually improved, and on September 27 was discharged.

On September 20, the stools were dark in color, fluid, frequent, and mixed with mucus. The temperature was 98; pulse 97, and respiration 18; at 9 P.M. 97.4 temperature; pulse 96, and respiration 16. He was very restless and complained of an obscure uncomfortable laryngeal sensation, which seemed to be more of a paresthesia rather than a pain. He passed a good night, and a sufficient quantity of normal urine was excreted. September 21, temperature during the day was 99.2; pulse 94 to 96; respirations 20 to 18. Three moderate sized whitish watery mucous stools were passed; the patient sat up during the day, but complained of pain in the left side; he excreted in twenty-hours 46 fluid ounces of urine. His improvement was so rapid that he was directed to sit up and sent to the convalescent ward. During the night he became worse and diarrhea returned, and he was again placed in the wards. September 26, temperature was 98.5 to 99; pulse 98 to 97; expirations 15 to 24. He passed three watery yellowish stools and slept on and off during the day and said that he felt much better. At no time was pain complained of. He passed thirty-two ounces of urine during the past twenty-four hours. September 23, temperature 99 to 99.5; pulse 76 to 80; respirations 16 to 22. He had passed six light colored, yellowish, liquid stools; there had been no vomiting; the urine was passed in normal quantities, and he had been able to sleep fairly well. September 24, pulse and respiration normal; sleep normal; no vomiting and there were but three yellowish watery stools, and the urine was normal in quantity. September 25, pulse, respiration and temperature normal; three liquid stools. September 26, he was discharged from the convalescent ward.

Treatment.—Calomel, ten grains, followed by one grain every hour for six doses. Enteroclysis, Ovj, every two hours; whiskey hypodermically, to the extent of drachms ij, which was administered during the night. Beef tea and Seltzer water p. r. n. September 21, an enteroclysis was given every four hours and whiskey, drachms ij, was given by the mouth every four hours. September 27, rectal injections of tannic acid solution were discontinued, and a light easily digested diet was ordered. September 23, enteroclysis was resumed, and on September 24, Squibb's cholera mixture, one drachm was given t. i. d. Whiskey, drachms ij was given three times daily as it was necessary to stop enteroclysis and hypodermoclysis.

The tenth case requires no special comment and occurred in a man aged 18, who was removed from the steamship *Bohemia*, to the ward of the hospital on September 20. On admission his temperature varied from 99.4 to 99.6; pulse 98 to 100; and respiration 20 to 24. He had considerable abdominal pain and diarrhea, and vomited continuously a greenish watery liquid.

September 21, respiration and temperature about the same, on several occasions a yellow greenish liquid was vomited, and five liquid movements occurred during the day. He slept well; the urine that was passed was normal in appearance and quantity. September 21, pulse, respiration and temperature unchanged; the vomiting and diarrhea were frequent, and the ejecta were milk-like in color and small in quantity, and contained some mucus. September 23, frequent vomiting of a yellowish liquid. One small stool passed normally. He complained of but a moderate amount of pain in the abdominal region and slept well. September 24, no complaint of pain; pulse, temperature and respiration unchanged. On September 25 he was considered convalescent, and was discharged the following day.

Treatment.—Upon admission he received a hot bath and was given ten grains of calomel; whiskey was given every four hours by the mouth, but it was rejected and we were compelled to resort to hypodermic injections of ten minims thrice daily. September 21, whiskey every four hours was ordered, and one enteroclysis of two pints was administered. September 22 was a repetition of September 21, and on the 23d whiskey was administered by the mouth in two tablespoonful doses every four hours, and a hypodermic injection of one-eighth grain of morphia for abdominal pains.

The eleventh and final case was one of great severity, and we attributed the favorable result largely to the treatment employed. It occurred in a girl, aged 6, admitted from steamship *Bohemia*, September 27, at 11 A.M., in a state of marked collapse, with coldness of the entire surface and with the characteristic facies of *Cholera Asiatica*, and cyanosis of the face and upper and lower extremities. Her mental condition is best described by the word "stupor." Her pulse was scarcely perceptible and very rapid. She had frequent attacks of vomiting and diarrhea, and the stools were fecal and dark in color. Her respirations were labored, shallow and 22 per minute. The pulse was 122. No urine was excreted. The temperature was 97.8° F. On September 28 the vomiting continued, and there were but two liquid stools. In the afternoon a moderate quantity of urine was passed—the first for thirty hours. The passage of the urine in our cholera cases was always viewed as a most favorable indication. The pulse improved in force and volume, the respirations were slow and labored

and the temperature was normal. On September 29, the pulse still showed signs of increasing strength, averaging 100 to the minute, the respirations were quiet and 20 per minute, the temperature normal, and a fair amount of sleep was secured. There had been but one liquid intestinal movement and a sufficient quantity of urine had again passed. On September 30, there was one act of vomiting which seemed to have been excited by the remedies administered. The respiration was normal and the temperature remained unchanged, and the pulse was small and weak, 100 per minute. But two loose intestinal discharges occurred. The improvement continued though she remained in a partial typhoid state. The urine was passed in moderate quantities, and in a few days she was discharged from the hospital.

Treatment.—Upon admission she received a hot plunge bath, an enteroclysis, a hypodermoclysis and camphor and ether m. xx hypodermically. Oxygen was administered p. r. n. She had hypodermic injections of ℥. x. of whiskey every two hours for five days. The enteroclysis was repeated every two hours and hypodermoclysis but once. On the following day, September 28, the enteroclysis was given at 9 and at 11 A.M., and at 1 P.M. the second hypodermoclysis was administered. The hypodermic injections of whiskey were persisted in. On September 29, the hypodermoclysis was administered at 1.30 P.M., and the enteroclysis at 1 and 5 A.M., and the hypodermic injections of whiskey were given at 10 A.M. and 4 P.M. September 30, hypodermoclysis and enteroclysis were suspended and seltzer water and tincture of senna were administered by the mouth. October 1, improvement continued, and during the day there were but two loose dark-colored stools and no vomiting.

Mortality.—Of the eleven cases of cholera under my personal observation, eight recovered and three died, which is a mortality of 27 per cent. As one of these cases died two hours after admission, it could be fairly excluded in giving the percentage of deaths of cases under treatment, which would reduce this mortality to 18 per cent.

The total number of cases admitted to the Swinburne Island Hospital was seventy-two, and the number of deaths was twenty, or a general mortality of 27 per cent. In addition, fifty-six suspects were admitted, of whom forty-six presented the prodromic symptoms of cholera. If these were included, our mortality would be reduced to 17 per cent. The mortality from all cases under treatment, including the forty-six suspects and excluding the deaths occurring within two hours after admission and those deaths occurring later from complications, would be 11 per cent.

The mortality of the cases of cholera that occurred on shipboard varied between 50 and 98 per cent., while the percentage of deaths in Hamburg varied between 50 and 60 per cent.

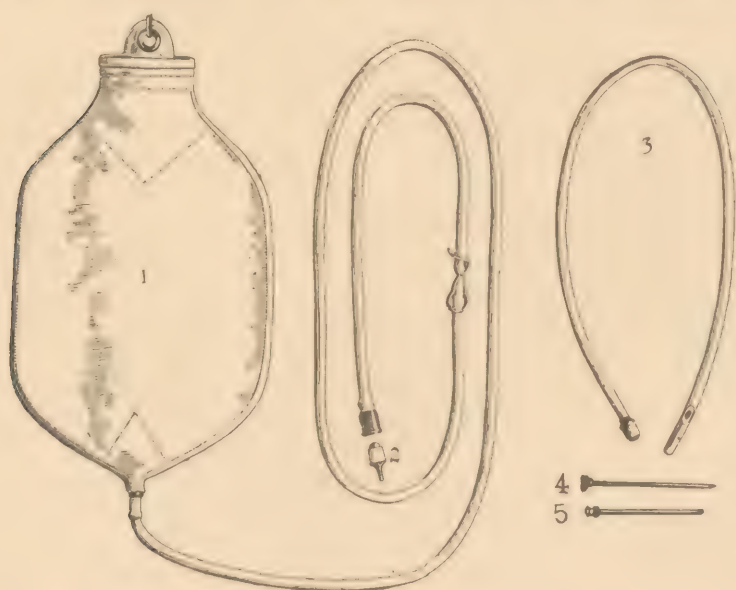
In considering the number of deaths in relation to the question as to how far the treatment was responsible for this low rate of mortality, it is well to remember that most of our patients were half-starved, rachitic and anemic Russian emigrants, many of whom were children; that they were in a specially weak condition, due to the long voyage and also to the fast days which their religion imposed upon them; that the premonitory stage in the epidemic was present to a slight degree or not at all; that many died before the treatment could be inaugurated, and that this epidemic was especially virulent.

Despite these unfavorable circumstances our general mortality was but 27 per cent., while that of Hamburg was from 50 to 60 per cent. After a very careful deliberation, in which we discussed everything that could have influenced the percentage of mortality, we were convinced that it was chiefly due to the method of treatment employed.

Treatment.—As to prophylactic treatment, the rules found necessary were both few and simple. Each of us wore a separate suit of clothes for the hospital, and avoided physical contact with patients except when it became necessary. Regularly, each time after examining a cholera case, we would wash the hands thoroughly with hot water and soap, afterward immersing them in a 1 : 500 solution of bichloride of mercury. The convalescents and those employed about the hospital were instructed to drink a lemonade of ten drops of hydrochloric acid to the glass of water. No ordinary water was used, and we drank exclusively of carbonated distilled water or Apollinaris water. All foods were thoroughly cooked, and green vegetables, salads, and indigestible foods were avoided. These precautions were so effective that, despite the dense ignorance of the people under our care, but two cases of cholera originated on Swinburne Island. In both instances these emigrants drank red wine until they became thoroughly intoxicated, and this was followed by acute catarrhal gastritis and infection by the spirillum of cholera. We had no experience in the treatment of the primary stage, as all our cases were fully developed when they came under observation.

In the treatment of the stage of collapse the patient was first immersed in hot water, and then given a subcutaneous injection of a quart of hot, sterilized water, containing six-tenths per cent. of sodium chloride and one per cent of brandy. This procedure is known by the name of hypodermoclysis. The first injection in an adult may be one or two quarts. In but one of our cases did an abscess form. Usually the only complaint made when this operation was frequently performed was sensitiveness and pain on light pressure over the region of the punctures. In favorable cases absorption takes place in from thirty to forty-five minutes, but in those cases where collapse approached death,

as long as four hours may be required. It therefore becomes evident that the rate of absorption is of great prognostic importance. The best position for these subcutaneous injections is in the flanks, in the region of the floating ribs, in the median axillary line, although it may be administered in the buttocks or inner aspect of the thighs. The neck is to be avoided, as there is danger of producing edema of the larynx. Ordinarily, a hypodermoclysis may be repeated every two hours, and in severe cases it may be well to inject one quart in each flank, repeating the injection so soon as it has been absorbed. In supplying the indication for heat it is necessary that the solution should



1. Rubber reservoir and tube of ordinary fountain syringe for administering hypodermoclysis.
2. Attachment for canula used for hypodermoclysis.
3. Soft rubber rectal tube.
4. Needle for hypodermoclysis.
5. Canula for hypodermoclysis.

have a temperature of about 104° F., and care should be taken that it is thoroughly sterilized immediately before it is introduced beneath the skin. In each of our cases a Davidson syringe was employed, but I would strongly urge the adoption of the ordinary fountain syringe, as by this means the liquid may be slowly introduced, and hydrostatic pressure controlled to a nicety by raising or lowering the reservoir. It requires from twenty to thirty minutes to introduce one quart of liquid, and usually it is unnecessary to attempt to disperse the fluid by manipulation, though it may be advisable in grave cases

where rapid absorption becomes necessary. As one would naturally suppose, this subcutaneous liquid forms a large oval swelling, the size depending upon the amount of liquid introduced.

A good working rule regarding the quantity of the injection is the following: For an adult, two pints; for adolescents, one pint; for an infant, half a pint.

We found that the best place for the hypodermoclysis was in the mid-axillary line in the region of the floating ribs. In an adult a quart of the solution may be introduced in this locality, and when the case is urgent a second quart may be introduced at a corresponding point on the opposite side. When it is desirable to change the locality, the inner surface of the thighs or the chest may be selected. Observation has shown that there is danger in the injection of liquid beneath the skin of the neck. Fatal edema of the larynx has been reported in two cases where the injection was made in this region.

An enteroclysis consists of a one to two per cent. solution of tannic acid, having a temperature of 45° C. or 113° F. For an adult, two quarts may be given; for an adolescent, one quart. This solution should be introduced very slowly, and in each of our cases the Davidson syringe was employed, but I should advise the use of a medium-sized soft-rubber rectal tube, having one outlet one-half inch from the extremity, and a second on the opposite side, two inches from the extremity, and the terminal portion closed so as to facilitate its introduction. In an adult this tube should be well oiled and gently and slowly introduced by a slight rotary and inward pressure for the distance of ten inches. To this tube should be attached an ordinary fountain syringe, the same as the one suggested for hypodermoclysis. The advantage of this method is that the hydrostatic pressure may be modified immediately to suit the particular case in question, and in this manner the rate of discharge of the liquid may be regulated. It is necessary that the solution should be *slowly* introduced, occupying not less than *ten minutes*. The tube should then be slowly withdrawn, and gentle pressure applied to the anus in an inward direction toward the anterior perineum. The patient should be encouraged to retain the liquid so long as possible. Not infrequently if the first desire to void the injection is overcome, it is retained without further difficulty.

It has been hitherto generally believed that the ileo-cecal valves prevented the entrance of liquids from the colon into the ileum. In many of our cases, after giving an enteroclysis of tannic acid we were convinced that the liquid entered the small intestines, and this opinion was strengthened when several of our patients vomited this same solution.

In order to investigate this matter more carefully, the following experiments were made:

A fountain syringe containing three pints of water was suspended at an elevation of five feet, and a rectal tube introduced for a distance of six to ten inches.

CASE I.—Male child, aged 2 years; dead of cholera; the liquid passed readily, filling the intestines and stomach.

CASE II.—Male child, aged 2 years; dead of marasmus; liquid passed freely, filling the intestine and stomach.

CASE III.—Child, aged 6 years; dead of measles; the liquid passed readily through the entire intestinal tract, and flowed from the mouth and nose.

CASE IV.—Child, aged 3 years; dead of measles; the liquid passed readily through the ileo-cecal orifice, filling the small intestine.

CASE V.—Child, aged 3 years; dead of measles; the liquid refused to pass. A post-mortem examination showed that the colon was over-distended and that there was a twist in the ileum against which the distended colon pressed, rendering it impossible for liquid to pass into the ileum.

CASE VI.—Female child, aged 18 months; dead of measles; the liquid failed to pass both before and after opening the abdominal cavity. In this case the ileo-cecal valve was small and the lips of the valve were in close apposition, rendering it impossible for any liquid to pass from the colon into the small intestine.

CASE VII.—Child, aged 2 years; the liquid refused to pass; upon examination the ileo-cecal valve was found to be competent.

These observations show that in two cases the valve was competent to prevent irrigation of the small intestine, and in one case, owing to the peculiar twist in the ileum and the pressure of the over-distended colon, liquids failed to enter the ileum. This case is particularly instructive, and shows that in a certain number of cases success may be looked for, even though the first attempt prove unsuccessful. In four cases there was no difficulty whatever in the passage of liquids from the anus to the stomach, or even out through the mouth and nose.

As coldness of the body and lowering of the *central temperature* is an almost constant condition in Asiatic cholera, it becomes necessary to supply heat. This is accomplished by heating the liquids used in hypodermoclysis and enteroclysis, and also by the hot plunge bath, which is always given to the patients in the state of collapse. I should further advise that the entire skin-surface be covered by soft, woollen undergarments, and from time to time hot air should be conducted beneath the bed clothing. Advantage may also be taken of hot air

bags and hot bricks. The patient should be covered by two woollen blankets and a counterpane. A most excellent practical suggestion to add to the heat of the body has been made by Dr. Francis X. Dercum, namely, that the patient be placed upon a water-bed, through which hot water should constantly circulate.

Stimulation.—The best method of administering stimulants is by deep hypodermatic injections of whiskey, repeated every hour or less frequently, according to indications. For an adult, twenty minims may be employed; for an adolescent, ten minims; and for an infant, five minims. During the stage of collapse, if there is any tendency to vomiting, it is wisest to avoid the administration of any substance by the mouth.

Lavage.—As the stomach frequently contains large quantities of choleraic liquid, it is often advisable that a soft rubber stomach tube be introduced, and that lavage be thoroughly performed, using the hot tannic acid solution as in washing out the intestines.

Hydrochloric Acid.—As the growth of the spirillum of cholera is inhibited by an acid medium, and as hydrochloric acid is the normal acid of the gastric juice, it is desirable that it be administered diluted in a glass of water at intervals of two hours. An adult may receive fifteen minims; an adolescent, ten minims; and an infant, five minims, taken slowly in sips.

Nourishment—Liquids.—The only nourishment that should be administered is peptonized milk, or milk that has been sterilized, in small quantities, about two ounces every two hours. If this is not well received, it may be surcharged with carbonic acid gas, or koumiss may be substituted. Iced champagne, in small quantities, may also be given, or iced wine-whey made in the proportion of one part of sherry wine to four parts of milk. The only liquid that should be permitted is carbonated distilled water. When vomiting is persistent, all attempts to administer remedies or food by the mouth should be avoided.

In conclusion, I cannot refrain from acknowledging my hearty thanks to Drs. Byron and Abbott, of the Loomis Laboratory, New York, to whom I am not only indebted for the opportunity of making this clinical study, but also for the many courtesies which I have received at their hands; and further, to Dr. Byron is due the credit of having initiated the treatment of these cases in the manner herein pointed out.

To Dr. Jenkins, the Health Officer of the port of New York, my thanks are due for his many kindly courtesies, and for the aid which at all times he gladly extended to me.

